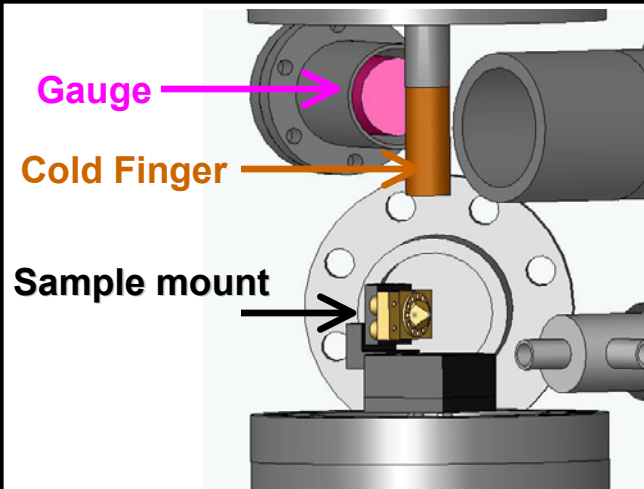


MRI-DMR-0216124: Development of a spectroscopic cryogenic ellipsometer for materials research and education.

PI: D.N.Basov (UCSD)

Objective: to develop a spectroscopic ellipsometer suitable for precision determination of the optical properties of complex materials at cryogenic temperatures.

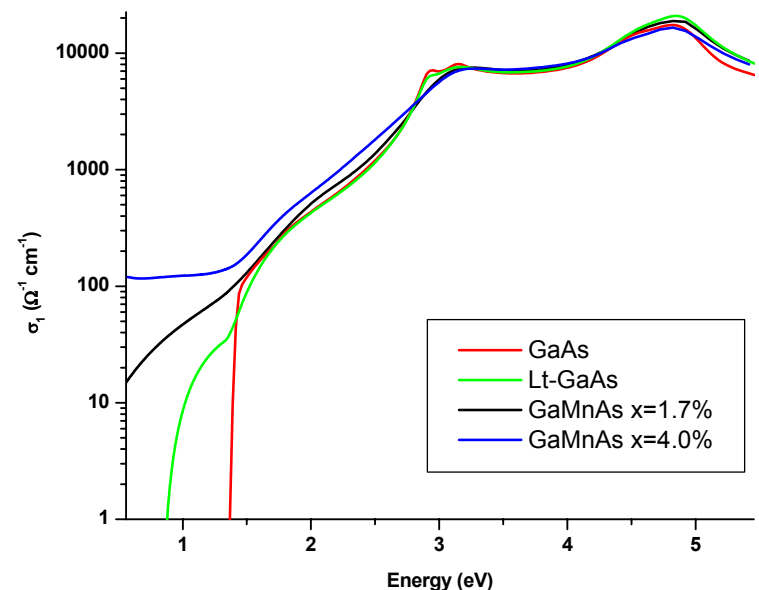


Ultra High Vacuum and low temperatures

A unique design is currently being implemented to allow incredibly accurate exploration of optical phenomena in exciting new materials at low temperatures. However to prevent ice from forming on the sample, an Ultra High Vacuum (pressures 12 orders of magnitude smaller than ambient pressure) must be achieved. An “insiders” view of the new design is pictured on the left.

Advancing Spintronics exploration into new realms

Previous optical studies on the new **Ferromagnetic Semiconductor GaMnAs** were limited to energies below the Band Gap. The new ellipsometer enables accurate characterization of their properties above the gap, offering unique insights into these exciting materials. Pictured on the right is the optical conductivity as a function of energy for a number of samples, including GaAs grown at low temperatures and $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ with different levels of Mn doping.



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Expanding education opportunities, research capabilities and industrial partnerships.

This MRI program features integration of research and education. Program currently supports two graduate students (Kenneth Burch, William Padilla). Several undergraduate students from the [Physics and Engineering](#) departments (Miguel Villalobos, Kevin Mikolaitis, Alex Schafgans) have participated in this project throughout the 2002-03 academic year and during the Summer of 2003. This program also involves partnerships with industry including J.A.Wollam and Bruker Optics. These two companies are interested in commercializing the unique ellipsometer that is being developed at UCSD.

Graduate student Kenneth Burch (left) and an undergraduate student Kevin Mikolaitis (right) work on installing components in the ellipsometer's monochromator. Expertise that is gained in the course of this project is unique since it bridges the boundaries of condensed matter physics, optics, and materials science. Currently there is high demand for qualified personnel with this particular combination of skills both in industry and academia.

